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PUBLIC HEALTH REPORTS

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VACCINATION OF SCHOOL CHILDREN.

COURT DECIDES THAT A LOCAL BOARD OF HEALTH MAY REQUIRE ALL CHILDREN ATTENDING CERTAIN SCHOOLS TO BE VACCINATED.

The Board of Health of Jefferson County, Ky., issued an order requiring that all children attending schools in School District No. 46, Highland Park, Ky., must be vaccinated, excepting such children as had been successfully vaccinated within seven years.

The board of trustees of the school district resisted the enforcement of the order, but the Court of Appeals of Kentucky decided that the board was authorized by the Kentucky laws to take the action, and that the order must be complied with.

The opinion is published in this issue of the Public Health Reports, pages 2173.

THE SANITATION OF RAILWAY CARS.[1]

By THOMAS R. CROWDER, M. D., Chicago.

The object of the sanitation of railway cars is to protect the health of passengers and crews. In order to do this effectively we must first know what the dangers are and how they act.

The dangers of railway travel may be separated into, first, the danger arising from mechanical accidents; second, the danger of contracting infectious diseases; and, third, the danger incident to a group of miscellaneous influences, such as prolonged confinement, uncomfortable seats, the rapid and variable motion of the train, faulty ventilation, heating, and lighting, and the breathing of dust, smoke, and engine gases.

A discussion of mechanical accidents lies rather beyond our present purpose. It is the business of engineers and car builders to guard against them. But the sanitarian may be privileged to insist that cars should be strongly built, able to withstand the enormous shocks to which they are normally subjected, be free from sharp angles and corners to catch the unwary as he moves through a swaying train, and so mounted as to keep the rails surely and with comfort to the passenger; with which brief declaration we may turn over the subject to its proper guardians. The other two divisions lie strictly within the sanitary field.

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[1] Read at meeting of the New York Railroad Club, Apr. 21, 1916.

It is only during the last 10 or 15 years that serious attention has been directed to railway sanitary problems. Although there is now a fairly voluminous literature on the subject, it contains little of the exact scientific observation on which efficient practice must be based. There has been a very general tendency to consider the railway car as a thing possessing some peculiar relation to disease in general and to infectious diseases in particular. This is an error. The car is only a special kind of house—it is a house on wheels—a temporary, mobile dwelling place. Its present form is the result of much evolution, only a small part of which has been dictated by hygienic considerations; but in its principal character it remains always a temporary habitation, not differing in other essentials than its mobility from other places where people live together in close proximity. The same sanitary principles apply to it, and the same sanitary practices are necessary for the car as for any other house, with the almost single exception that sewage can not be similarly disposed of. Failure to recognize this essential similarity has led to many unnecessary laws and regulations, some of which have no relation whatever to the public health, and in which the major and minor issues have often been so confused as to act as a real obstruction to sanitary progress.

It is the great aim of sanitation to prevent the spread of infectious diseases, to which end most of our major sanitary practice is directed. It should be understood at once that these diseases are caused, with few exceptions, by microscopic vegetable parasites growing in the bodies of affected persons, that the organisms are contained in and thrown off with the secretions and excretions of the body, and that they are transmitted from person to person only by the transfer of the causative organism from person to person. In the infectious diseases we are dealing with a subtle and elusive enemy, one whose movements are difficult to follow; but whether followed or not there must always be a material transfer of some substance containing disease germs before infection can take place. It does not need to pass directly from one person to another; the route may be devious and obscure; but whether direct or devious, the source is invariably a previous infection. It logically follows that the fundamental necessity in preventing the spread of infectious diseases is to prevent the promiscuous distribution of the secretions and excretions of infected human beings. They must be so disposed of that they will not contaminate the air, or the food, or the drink that is to be taken into the bodies of other individuals.

When we cough, or sneeze, or speak aloud, we expel a finely divided and invisible spray into the air in front of the face. It is not carried far; unless borne up by air currents it rapidly settles upon the floor or surrounding objects. But if some one stands near enough to breathe immediately into his lungs our spray-laden expelled air, he may get our disease. When we drink from a cup we leave a little saliva on the rim; another, drinking, may swallow it. Fingers, soiled with urine or feces containing typhoid bacilli, in handling food for another's consumption may transmit typhoid fever. Sputum dried upon the floor may be ground to dust, blown up by the wind, and enter the lungs of him who breathes the air.

From all of which it is apparent that infection in occupied places may be contracted in three ways—1, by direct transmission from person to person through the agency of mouth spray and intimate personal contact; 2, by indirect transmission through food and drink and from the common use of utensils or other facilities for comfort and convenience; and, 3, from infected premises. So far as railway cars are concerned, the first of these is the most important. With the exception of a few diseases which are generally conveyed through food and drink, such as typhoid fever, the accumulating evidence of recent years is making it more and more clear that the majority of transmissible infections are passed with relative directness from person to person. We are coming to understand that people, and not things, are the chief agents of disease transmission as well as the sources of infection; that the thing that counts is the actual presence of the infected person.

Applying this brief statement of principles to the subject under discussion, it becomes obvious that the first and foremost necessity in protecting those who travel is to keep out of cars all people who are known to be infected with communicable diseases. I do not need to point out the difficulties which confront the railroads in attempting to do this. Under their legal obligation to furnish transportation they have little power to discriminate among those who apply for it. It is not possible to refuse accommodation except under certain well-defined conditions, which, in so far as the communicable diseases are concerned, must include a definite diagnosis, and this the railroads are not, and can not be, prepared to make. Since, in the nature of things, the infected person is the one most likely to be informed, the proper remedy would seem to lie in legislation placing the responsibility on the passengers themselves and making it illegal for those afflicted with communicable diseases to ask for or to accept transportation from common carriers.

Such legislation has been passed in one form or another in some 28 States, but there has been little attempt to enforce its provisions or to make them generally known. In addition to these State laws, there has just been issued by the Federal Government a revision of the Interstate Quarantine Regulations, which denies absolutely to all persons having the more dangerous and readily transmitted infectious diseases the right to enter public conveyances, and which on all those with infections that are less readily transferred puts such restrictions as will render them without danger to other travelers. The regulations are so designed as to protect the railways in their refusal to carry people with transmissible diseases and to place upon the traveler the responsibility of declaring his condition. This is as it should be. But the railways may help, and should help, to make the regulations effective by willing compliance when their case is clear, and by insisting that their patrons also comply with those sections which relate to them.

To the extent that these regulations can prevent the dangerously infected from traveling, they will protect the public health. But, unfortunately, the infected person can not always be identified. Only pronounced disease is commonly recognized on brief inspection, and infection does not always cause pronounced disease. One may be infected with the virulent germs of a disease and yet not be sick of it, or his illness may be no more than a slight indisposition, the real nature of which he does not even suspect. Many people are so afflicted. A mild sore throat may be diphtheria; a trifling rash may be smallpox, measles, or scarlet fever; a little cough which scarcely discommodes the patient may throw myriads of tubercle bacilli into the surrounding air. Even typhoid fever, generally a serious and prolonged disease, does not always bring its victim to his bed. There are people also who, for months or years after recovery, harbor the bacteria of an infection from which they have previously suffered, and who remain entirely well while they constantly spread their virulent germs about them.

From these mild cases, and from these infected well who are known as "carriers," severe cases may be acquired by those who are more susceptible. It follows, therefore, that regulations segregating the known cases of communicable diseases from cars is only a partial protection to the well; and, while the actually sick are the more important element in spreading the acute infections, some chances must always be taken from those whose disease is not apparent. Until each passenger has grasped, and has applied for his own and his fellows' protection, the idea of nonpromiscuity in his personal relations and in the disposal of his body's products, there can be little improvement in this feature of public assemblage. It is simply a question of applying the golden rule: Refrain from sneezing in your neighbor's face. Each one must learn to keep his own secretions to himself and each to avoid the secretions of others. And he who knows himself to be a source of danger should be doubly careful. The world is sadly in need of education along this line.

One of the most serious communicable diseases to which travelers are exposed is pulmonary tuberculosis. While it may be contracted in various ways, direct transmission through the medium of mouth spray is probably one of the most frequent and important. Although its prevalence and destructiveness are appalling, public sentiment will not approve of limiting greatly the movements of its victims. The railroads can not deny them transportation as dangerous passengers while they are permitted the freedom of all other places, public and private. It would undoubtedly be a valuable public-health measure to restrict the freedom of the tuberculous; but their number is so great, their disease is so chronic in its course and leaves them so long in comparative health and comfort that segregation is entirely impractical. The almost universal belief that changes of climate may hasten their recovery keeps them traveling in search of health.

We are all undoubtedly exposed to this widespread infection many times in our lives. Childhood is believed to be the period of greatest susceptibility to infection. Necropsy records are said to show that nearly all adults have actually been infected at some time, so that the little more exposure involved in the health seeker's travel is probably of no great consequence. It is an infection which seems to be slowly acquired by intimate contact and by long exposure, and the time of exposure in railway cars is neither long nor necessarily close. Careful habits in disposing of mouth secretions and in protecting the air from mouth spray can so nearly overcome the danger that it practically disappears. The new Interstate Quarantine Code recognizes this and permits the tuberculous to occupy cars, but it prescribes that they must be provided with and must use the means of preventing contamination of their surroundings. The railways can improve their sanitary efficiency and aid in protecting their patrons by enforcing the regulation.

It is often proposed that special cars should be furnished for the diseased, especially for the tuberculous. Leaving aside the serious economic difficulty, it would be impossible to get more than a small proportion of the tuberculous into such special cars. It is not the bedridden consumptive who presents the greatest danger of infecting his associates. Him we can identify and control. Far more important is the patient, either unsuspected or showing no conclusive evidence of his disease, who travels as a healthy individual, for of this class there are many more going about the world than of those severely sick. So the question remains not so much one of who shall use the car as of the habits of those who use it.

In this connection I scarcely need to allude to the duty of the railroads to furnish healthy crews for trains and to prevent overcrowding of cars. While the latter evil is largely confined to suburban traffic, the long-run day coach is not always free from blame. When they have done these things, and have done all they can to keep communicable diseases out of their cars, the railways have discharged their duty in relation to the direct transmission of disease. But what may they do to prevent its indirect transmission by reason of the common use of facilities for comfort and convenience?

While pathogenic organisms are mainly parasitic, growing only in the body of a host, they may remain viable for a considerable time outside the body and produce disease if they gain entrance. The contraction of disease by infection is so largely a matter of individual resistance and susceptibility that it is impossible to generalize about it. The number of organisms which in one person produce a disease may be quite innocuous to another. As with poisons, there is always a dose too small to do damage; so that absolute sterility of the things we use, even freedom from pathogenic organisms, is not necessary for the great majority to escape infection. But contamination of the things we use is always potentially dangerous, and it is right that the railroad should be required to provide facilities whereby the use of contaminated things may be avoided and its passengers may carry out to the utmost their own protection.

One of the things through which disease is most readily transmitted by the indirect route is the common drinking cup. Infected lips leave bacteria on the rim, and other lips pick them up. Ten years ago the common cup was universal on railway trains; now it is a thing of the past. Thanks to the initial temerity of Kansas in 1907, a reform was started which has now become complete. The common towel was another very real evil. It has gone the way of the cup. The comb and brush, while less important, should be induced to make a similar exit.

Ample provision should be made in all railway cars for travelers to keep their hands and faces clean. Lavatories should be conveniently located, supplied with an abundance of water, well drained and trapped, and should have smooth surfaces for easy cleaning. Towels should be constantly at hand and in sufficient quantity for individual use. There should be a place for brushing the teeth—a dental lavatory—in all cars which make long journeys. Using a wash basin for this purpose is to make a cuspidor of it.

Toilets should be always available, well flushed, perfectly emptying, and capable of easy cleaning. The old type of open hopper, with its up draft of wind and dust and its nearly constant fouling, is disagreeable, and passengers avoid its use, to the detriment of health. Cuspidors should be provided that spitting may not become an insanitary nuisance. Though it is often insisted upon by laws and regulations, the disinfection of cuspidors and toilets is largely æsthetic and sentimental. What goes into them is not touched, can not fly into the air, and has gone where it will not do harm; and unless it becomes a nuisance to sight or smell, our attention should be directed rather to discharges which fail to reach their proper place of disposal. The fallacious drip machine—the so-called continuous toilet disinfector—should be mentioned only to be condemned. It does not disinfect; it only distils an odor, sometimes worse than the one it tries to hide, and diverts attention from conditions that need mending.

Day coaches should have cans for garbage and refuse. Not that garbage and refuse carry infectious diseases—that is another of the fallacies of popular thought—but particles of food and other rubbish may be picked up from dirty floors by children or taken by them from a cuspidor in the mouth of which it lodges.

An ample supply of pure and wholesome drinking water is always necessary. It should be supplied and stored in such a way that it can not readily be contaminated by passengers. Ice that goes into the water should also be pure and clean, and must not be handled with bare hands which may be the carriers of excretions and disease. Better yet, ice should not go into the water at all, but into a separate compartment of the cooler, as is now required by some of the States and is being carried out by numerous corporations regardless of regulation.

In the dining car we meet the most important of the problems of indirect transmission of disease. Many of the infections may be contracted through the medium of food and drink, and some of them, as typhoid fever, are commonly transmitted in this way. Cleanliness in the preparation and handling of food is therefore all important to the public health. Especially milk and cream and vegetables to be eaten raw must be produced and stored in such a way as to avoid contamination. But more important still is the supervision of the health of dining-car employees to the end that those harboring transmissible infections may be excluded from the service. Periodic examination of cooks and waiters should be made at frequent intervals, certainly not longer than quarterly or half yearly, and those found infected with tuberculosis, venereal diseases, typhoid fever, diphtheria, etc., should be dismissed until complete recovery has taken place.

The typhoid "carrier" is an especially dangerous person in the kitchen. Numerous small epidemics of the disease have had such a starting place, the infection being carried to food in course of preparation by hands contaminated with human discharges. Every dining car should have a lavatory for the crew, and the most rigid supervision should be instituted to see that it is always patronized and that the nails are properly manicured before beginning service. Some railroads now provide for this examination and supervision. It is only a question of time when all will be compelled to do so, and perhaps also to inoculate their dining-car crews against typhoid.

The sources of food supplies should be chosen on the basis of the purity of their products, and the food should be handled in such a manner that it can not become contaminated with human excretions. It must be protected from flies, which breed in filth, feed on filth, and deposit filth where they alight. No argument can excuse their presence in the dining room, nor on food in process of preparation or transfer to the cars.

There has been much comment during the last few years on the use of the finger bowl, with proposals here and there to abolish it entirely. The harm it does is problematic; I believe it is insignificant and practically negligible; but the care of drinking glasses and of eating utensils is of genuine importance. They should pass through boiling water before they are served to patrons.

There has occasionally been severe criticism of those railroads which allow their crews to sleep in dining cars. The practice is undesirable from an operating standpoint, but under some conditions it is almost unavoidable, and I can not see that it does any harm from the hygienic standpoint.

When we come to consider hangings, linen and bedding, floors, carpets and upholstery, and their possible relation to the health of travelers, we are brought to a discussion of the third method of possible infection in railway travel, namely, by the car itself being infected in such a way as to be dangerous to its occupants. This is dealing simply with a new phase of the question of indirect transmission of disease—indirect transmission from previous passengers or from extraneous sources through the medium of infected premises.

Very little experimental work has been done on the bacteriology of the railway coach. The best was carried out by Kinyoun many years ago. He found various pathogenic organisms in the dust from the floors and furnishings of cars, but only a few of them retained their virulence, and these in slight degree. Since all human beings are to a certain degree infected, the places they occupy are also infected to some extent, and Kinyoun's results are only what might have been expected; they are the common findings of all inhabited places. They have been amply confirmed for other habitations and go to support my earlier contention that cars and houses lie in the same hygienic category and are subject to the same sanitary laws.

Though we must expect most cars to contain pathogenic bacteria in greater or lesser numbers, their presence is no proof of a dangerous degree of infection. Much evidence has been accumulated in recent years which seems to show that the places vacated by the sick are without danger to the well unless very gross contamination has occurred and no adequate precautions have been taken to destroy it. In order to acquire an infectious disease we must receive organisms in sufficient quantity and of a sufficient degree of virulence, and neither the quantity nor the virulence is liable to be great enough in cars to transmit a disease to their occupants.

It is nevertheless desirable that the railroads should take precautions to keep car infection down to a minimum. This may be done in two ways: By mechanical cleaning, which removes the bacteria; or by fumigation, which kills them. Of the two methods, the former is much the more important. Mechanical cleaning will not remove all the bacteria, for it can not remove the last particle of dust or dirt in which they are contained; but if it is well done, not enough will remain to be of any danger to passengers who use the car.

The method used in the cleaning of cars is of less importance than the effect produced, which must be reasonable cleanliness in all instances. For bare floors, toilets, woodwork, and utensils, soap, water, and elbow work are the important ingredients which must enter into the process. For dislodging dust from corners and angles, an air blast is both rapid and efficient. For removing it from carpets and fabrics, the vacuum process is best; it not only removes the dust, but collects it for final and quick disposal. But vacuum cleaning without sufficient power is a makeshift. It requires at least the equivalent of 1 horsepower, with not more than 50 feet of hose, to operate a single sweeper effectively. Some two years ago, as a member of a committee to investigate car cleaning, I went through this subject in an experimental way. In the beginning of the investigation there was no vacuum machine on the market which was well adapted to the work in car-cleaning yards, but one was soon developed which not only does better cleaning than the older compressed-air process but also does it cheaper, as has been amply verified by two years of practical application.

Ten years ago there was an epidemic of regulations requiring the fumigation of cars at frequent periodic intervals. If properly carried out, there is no doubt that fumigation will kill the vast majority of the bacteria in a car. But it is a procedure which has been much overworked in the past and which is not a proper substitute for thorough mechanical cleaning. Good cleaning is necessary in any event; and after it has been done not enough bacteria will remain to be of any real hygienic significance. In recognition of this fact the movement for periodic fumigation is now dying out. The tendency is rather to require it only after serious infectious diseases are known to have been carried, as is done by the new Interstate Quarantine Code. No reasonable objection can be made to that demand; and, even though the good it does is questionable, the roads should adopt the plan as a part of their own regulations.

In addition to providing for the sanitary arrangements outlined above, the roads have another duty in relation to the infectious diseases, and that is to instruct their employees in the principles that govern the protection of public health, to make rules for their sanitary guidance, and to see that these are obeyed. Instruction in this regard I look upon as important. I believe it can be made very useful in railway sanitary work. Some two years ago I prepared for the instruction of Pullman employees a little pamphlet in which I attempted to show, by means of a brief and simple statement of the origin of infectious diseases and the modes of their transmission, the reason for the existence of certain rules with which employees must comply, in the belief that better compliance will be obtained when the reason is understood. While the pamphlet deals with a few things beside the infectious diseases, such as heating and ventilation, it concerns those diseases chiefly, and attempts to state in simple language what influence the actions of employees may have in aiding or preventing their indirect transmission. The rules are only such as ought to apply in all railway service. They prohibit dry sweeping, dusting, and brushing, and the use of the common cup; they refer to the care of ice and water, to the cleaning of cuspidors, basins, and hoppers, and to the use of disinfectants and fumigation.

The miscellaneous influences constituting the third group of the dangers of railway travel, as I have outlined them, affect the health of car occupants only indirectly. They tend to reduce resistance rather than to produce disease directly. Certain individuals have peculiar susceptibilities of the nervous system rendering them liable to attacks of car sickness during any extended journey. There are people, too, who almost invariably have attacks of migraine, or sick headache, under similar conditions. It is not possible to prevent these results in the predisposed, though smooth roadbeds and comfortable cars probably tend to lessen the liability of their occurrence.

In the planning of railway cars too little attention has been given to the shape of the seats. The ordinary car seat is not supremely comfortable, and the nervous strain of riding all day long on an uncomfortable seat can not be disregarded. The seat should be so shaped as to conform to the curve of the back, which it usually is not; it should be at the proper distance from the floor—many are now too high; it should extend high enough to support the head; and a foot rest in front adds greatly to its fitness for its intended purpose.

The lighting of cars at night would not seem to be a difficult task, and yet, with the exception of dining cars, which, for æsthetic reasons, have received the most attention, properly lighted cars are rare. The light should be evenly distributed, and so placed that it will not shine in the eyes with a direct glare. If exposed lamps are used they should be placed as high as possible; if placed low down they should be shaded or have opal or frosted globes. The low ceiling of the coach would seem to lend itself readily to the indirect or semidirect system of lighting, which is a nearer approach to the ideal.

Ventilation is an always vital sanitary problem. Good air is of prime importance to good health. Ten or twelve years ago attempts to supply good air to railway cars were generally failures. The problem seemed complicated and almost hopeless. It still has its difficult points, but thanks to the enlightening research of the last 10 years it is now much simplified. We have learned what good air is: It is air that bears a proper thermic relation to the body. It must be able to absorb the body heat as rapidly as formed, without being cold enough to produce discomfort. It must be warm, but not too warm; it must have motion, but not enough to cause a chilling draft; it must be changed constantly to prevent stagnation and overheating. When these conditions, which are purely physical, are complied with, practically all other things may be left out of consideration. The chemical changes brought about by respiration are ordinarily negligible.

Due to the high wind pressure to which running trains are constantly subjected, a surprising amount of air enters them even when no special provision is made for it. I believe the quantity can always be kept adequate by the application of a simple exhaust system, as is now done on many lines. A much more difficult problem than maintaining the air supply is the proper control of heat. If the temperature is carefully regulated to between 65° and 70° F. complaint of poor ventilation will rarely arise, even with impure air and a very small supply; but above 70° trouble comes quickly and we think there is not enough air being supplied to keep our lungs flushed out. That is not the trouble at all, for let the temperature drop to the lower sixties and the air supply remain the same and we think the amount too large. The income and the outgo of air create motion within the car. When the temperature is too high we need more motion, hence a larger air supply, to keep the body cool; when it is too low we need less motion, or a smaller air supply, to keep the body warm. The lungs and the function of respiration have nothing to do with this; it is entirely a surface function. The practical problem of ventilation is thus seen to be one of physics, not one of chemistry. Its purpose is not so much to supply pure air as to supply air that will maintain the body's thermic balance through acting on its surface. Therein lies the reason that a fan can often be made to serve as good a purpose as an increased air supply.

With a simple exhaust system of ventilation, specific air inlets are not necessary unless cars are greatly crowded. Natural crevices, to which may be added open sashes in the end doors, will be sufficient. For supplying artificial heat, direct radiation is better than indirect. Little cold streams of incoming air, mixing with the warmer and stiller body of air within, contribute the stimulating variation of surface environment which is so necessary to comfort and health. Only when large quantities of cold air are admitted at one place is heating of the incoming stream desirable, and this is not a good plan for ventilating railway cars. When no artificial heat is needed, as in the warm summer months, nothing can take the place of open windows, for large streams of rapidly moving air are necessary to maintain the thermic balance of the body.

A certain amount of dust, smoke, and engine gases inevitably enters cars. This is, of course, liable to great variation. Smoke and gases are never really troublesome except in passing through tunnels, when they produce no more than temporary discomfort. I have examined many specimens of tunnel air and have found the gases of combustion always far below the point of danger.

Ordinary dust is of more importance because it is more prevalent and because it is possibly infectious. If not infectious it is at least irritating and uncomfortable, and prolonged breathing of a heavily dust-laden atmosphere predisposes to infections of the respiratory tract. Its sources from within the car should be limited by good cleaning, and by the prohibition of dry dusting, brushing, and sweeping while the car is occupied. When cleaning is well done and disturbance of car furnishings is avoided, carpets and plush are better than bare floors and smooth upholstery because they hold the dust that settles on them and prevent its redistribution.

The chief source of dust, and the only one of any real importance, is the roadbed. In hot, dry weather, when cars must be run with open windows, it is often troublesome. The best and about the only way to combat it successfully is by sprinkling the tracks with oil. This is now done on some lines where crude petroleum is plentiful and cheap.

The discussion of roadbed dust brings us to the one feature of the sanitation of railway cars which is entirely distinctive—which is unique from the very fact that the car is a mobile house—and which is strictly a railway problem. I refer to the disposal of sewage and to the subject of track pollution by human excretions. The problem of sewage disposal does not take on the same form in any other place, and certainly the method of solution on the railway can not be the same as that which is ordinarily applied to stable habitations.

Sewage from car toilets must either be dropped on the surface of the tracks or it must be received into some portable container.

As yet we do not know the whole hygienic significance of track pollution. It should be studied with care. Two things may conceivably bring danger—either discharges may be washed from the tracks into bodies of water which are used for domestic supply, or they may dry, become pulverized, be blown up as dust by the wind or passing trains, scattered to the neighborhood, or blown into passing cars. Our knowledge is now sufficient to assure us that the first of these dangers is real, and that where track drainage is into domestic reservoirs the protection of the reservoirs is demanded. While it is well known that bacteria are rapidly destroyed in running streams, the drainage from tracks may be much too direct for such action to take place, and where reservoirs are near the lines the drainage must be so arranged that contamination of the water supply will not occur.

It is by no means clear, however, that there is any danger of infection from roadbed dust, and against its probability stand several important facts. Railway tracks are almost universally exposed to sunlight, and sunlight is inimical to bacteria; it soon destroys the disease-producing kinds. Drying is also harmful to bacteria, though in a less degree. But drying and pulverization take time, which allows the natural destructive forces to act. By the time that sewage has dried on the tracks, become reduced to dust, and carried into the air in a finely divided state it is highly improbable that it can still contain pathogenic organisms in a virulent condition. It was shown by the investigations of Kinyoun, already referred to, that the dust outside of railway trains contains much fewer bacteria than that from within the cars. The evil would seem to lie in the dust as such—in the irritation caused by the breathing of pulverized earth, rock, and cinder—and not in the bacteria it contains. The discharge from car toilets can have no appreciable effect on its gross amount in the air about moving trains. It is comparable to the dust of streets, though it is produced more slowly and contains less organic matter. While the direct evidence is still not entirely clear, it seems to me that it may be quite right to believe that where domestic water supplies are not concerned track pollution is of little or no hygienic importance, and that when all the facts are known the many extravagant statements that have been made about it will find their proper level near the zero mark of sanitary significance.